

# Sample Paper

## PHYSICS

Time: 20 min

Max Marks: 40

10 Questions (Mixed: Section A &amp; B)

- A particle moves with velocity  $v = at^2$ . What is its acceleration at time  $t$ ?  
(A)  $2at$  (B)  $at^2$   
(C)  $t^2$  (D) constant
- A body is projected at  $45^\circ$  with speed  $u$ . The ratio of horizontal range (R) to maximum height (H) is:  
(A) 2 (B) 4  
(C) 8 (D) 1
- Unit of electric flux is:  
(A)  $Nm^2/C$  (B)  $N/C$   
(C) J (D) W
- Two resistors of  $4\ \Omega$  and  $6\ \Omega$  are connected in parallel. The equivalent resistance is:  
(A)  $2.4\ \Omega$  (B)  $10\ \Omega$   
(C)  $1\ \Omega$  (D)  $5\ \Omega$
- In SHM, the total mechanical energy of the system depends on:  
(A) Displacement (B) Amplitude<sup>2</sup>  
(C) Time (D) Phase
- A capacitor charged to potential  $V$  is disconnected from the battery and a dielectric slab is inserted fully between the plates. What happens to  $V$ ?  
(A) Decreases (B) Increases  
(C) Remains same (D) Becomes zero
- Magnetic force on a moving charge is maximum when the angle between velocity and magnetic field is:  
(A)  $0^\circ$  (B)  $90^\circ$   
(C)  $180^\circ$  (D)  $45^\circ$
- A wire of length  $L$  and resistance  $R$  is stretched so that its new length becomes  $2L$  (volume constant). New resistance is:  
(A)  $R/2$  (B)  $R$   
(C)  $2R$  (D)  $4R$
- Escape velocity from the surface of a planet depends on:  
(A) Mass of body only  
(B) Radius of planet only  
(C) Both mass and radius of planet  
(D) Neither
- According to Lenz's law, the direction of induced emf is such that it:  
(A) Opposes the change in magnetic flux  
(B) Supports the change in magnetic flux  
(C) Always remains constant  
(D) Becomes maximum

## ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans	A	B	A	A	B	A	B	D	B	A

## EXPLANATIONS

- (A)  $2at$   
 $v = at^2 \Rightarrow a = \frac{dv}{dt} = 2at$ .
- (B) 4  
 $R = \frac{u^2}{g}$   $H = \frac{u^2}{4g} \Rightarrow \frac{R}{H} = 4$ .
- (A)  $Nm^2/C$   
Electric flux  $\Phi = EA \Rightarrow \text{unit} = (N/C) \cdot m^2 = Nm^2/C$ .
- (A)  $2.4\ \Omega$   
 $\frac{1}{R} = \frac{1}{4} + \frac{1}{6} = \frac{5}{12} \Rightarrow R = \frac{12}{5} = 2.4\ \Omega$ .
- (B) Amplitude<sup>2</sup>  
Total energy in SHM:  $E = \frac{1}{2} kA^2 \omega^2 \propto A^2$ .
- (A) Decreases  
Dielectric  $\uparrow \Rightarrow C \uparrow$ . Since  $Q$  constant (battery disconnected),  $V = Q/C \Rightarrow V$  decreases.
- (B)  $90^\circ$   
Magnetic force  $F = qvB \sin\theta \Rightarrow \text{max at } \sin\theta = 1 \Rightarrow \theta = 90^\circ$ .
- (D)  $4R$   
 $R = \frac{\rho L}{A}$ . If  $L \rightarrow 2L$  and  $A \rightarrow \frac{A}{2}$  (volume constant),  
 $R' = \frac{\rho(2L)}{A(1/2)} = 4R$ .
- (B) Radius of planet only  
 $v_e = \sqrt{\frac{2GM}{R}} \Rightarrow \text{depends on } M \text{ \& } R \text{ of planet, not mass of body.}$
- (A) Opposes the change in magnetic flux  
Lenz's law: induced emf direction opposes the change that produces it.

## Sample Paper

## CHEMISTRY

Time: 20 min

Max Marks: 40

## 10 Questions (Mixed: Section A &amp; B)

- pH of  $10^{-3}$  M HCl is:  
(A) 1 (B) 3  
(C) 10 (D) -3
- Atomic number determines:  
(A) Mass (B) Identity  
(C) Volume (D) Charge
- Rate law depends on:  
(A) Products (B) Experimental data  
(C) Catalyst (D) Stoichiometry
- Hybridization of  $\text{CO}_2$  is:  
(A) sp (B)  $sp^2$   
(C)  $sp^3$  (D)  $sp^3d$
- $\text{H}_2\text{O}_2$  is an \_\_\_\_\_ of hydrogen peroxide.  
(A) Structural formula (B) Empirical formula  
(C) Condensed formula (D) Molecular formula
- Which is the strongest acid?  
(A) HCl (B)  $\text{H}_2\text{SO}_4$   
(C)  $\text{HNO}_3$  (D)  $\text{HClO}_4$
- Catalyst:  
(A) Is same for all reactions.  
(B) Does not change overall enthalpy  
(C) Changes activation energy  
(D) Changes equilibrium constant
- A capacitor charged to potential V is disconnected from the battery and a dielectric slab is inserted fully between the plates. W?  
(A) HCl (B)  $\text{H}_2\text{SO}_4$   
(C)  $\text{HNO}_3$  (D)  $\text{HClO}_4$
- Catalyst:  
(A) Is same for all reactions,  
(B) Does not change overall enthalpy  
(C) Changes activation energy  
(D) Changes equilibrium constant
- Buffer solution is given by mixing:  
(A) Strong acid and weak base  
(B) Weak acid and its salt  
(C) Strong acid and strong base  
(D) Strong acid and its salt
- Oxidation is:  
(A) Loss of electrons  
(B) Gain of electrons  
(C) Loss of protons
- \_\_\_\_\_ atomic radius in the periodic table because  
(A) Decreases down a group  
(B) Increase across a period  
(C) Increases down a group;  
(D) Become fully filled.

## ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	8	9	10
Ans	B	B	B	A	A	B	A	B	D	B	A

## EXPLANATIONS

- (A)  $\text{pH} = -\log[\text{H}^+] = -\log(10^{-3}) = 3$ ,
- (B) Atomic number is the number of protons, determines the atom's identity.
- (B) Rate law depends on:  
(A) Products (B) Experimental data  
(C) Catalyst (D) Stoichiometry
- Hybridization of  $\text{CO}_2$  is:  
(A) sp (B)  $sp^2$   
(C)  $sp^3d$  (D)  $sp^3d$
- (D)  $\text{HClO}_4$  is the strongest common acid.
- (C) Catalyst changes the rate of a reaction by lowering the activation energy.
- (B) Buffer = Weak acid + its salt  
weak base + its salt, Resists pH change
- (A) Oxidation is defined as the loss of electrons.
- (C)  $\text{H}_2\text{O}_2$  is represented as H-O-O-H, same empirical and molecular formula.  
Empirical; simplest whole number ratio of elements, Molecular = real formula.

## Sample Paper

**BIOLOGY**Time: 20 min  
Max Marks: 40

10 Questions (Mixed: Section A &amp; B)

**ZOOLOGY (1–5)**

- 1** Mitochondria are:  
(A) Powerhouse of the cell  
(B) Control center of the cell  
(C) Storage organelle  
(D) Protein synthesis site
- 2** Assertion (A): DNA replication is semi-conservative.  
Reason (R): Each strand of DNA serves as template for new strand.
- 3** Hormones secreted from pancreas are:  
(A) Insulin (B) Pepsin  
(C) Estrogen (D) Testosterone
- 4** ABO blood group shows:  
(A) Multiple alleles (B) Estrogen  
(C) Incomplete dominance (C) Pleiotropy  
(D) Epistasis (D) Epistasis
- 5** Glycolysis occurs in:  
(A) Cytoplasm (B) Mitochondria  
(C) Thylakoid (D) Ribosome

**BOTANY (6–10)**

- 6** Nitrogen fixing bacteria is:  
(A) Azotobacter (B) Nitrosomonas  
(C) Pseudomonas (D) Rhizobium
- 7** According to Mendel's law of segregation, each allele:  
(A) Joins with similar allele.  
(B) Segregates into gametes  
(C) Segregates independently
- 8** Constituent of xylem for water transport is:  
(A) Phloem  
(B) Collenchyma  
(C) Sieve tubes
- 9** CAM plants live in:  
(A) Cold climate  
(B) Desert condition  
(C) Humid areas  
(D) Freshwater ponds

**ANSWER KEY**

Q.No.	1	2	3	4	5	6	7	8	8	9	9	10
Ans	A	A	A	A	A	D	B	B	D	B	B	C

**EXPLANATIONS****EXPLANATIONS**

- 1 (A)** Mitochondria are powerhouses of cell producing ATP during respiration.
- 2 (A)** DNA replication is semi-conservative as each strand of DNA serves as template for new strand.
- 3 (A)** Hormones secreted from pancreas include insulin, which regulates glucose/blood sugar.
- 4 (A)** ABO blood groups controlled by multiple alleles, genes ( $I^A$ ,  $I^B$ , and  $i$ ).
- 5 (A)** Glycolysis is the first step of cellular respiration and occurs in cytoplasm.
- 6 (D)** Rhizobium is a nitrogen fixing bacteria in legume root nodules.
- 7 (B)** During gametes formation, the two alleles segregate such that one gamete only gets one allele from pair.
- 8 (D)** Tracheids and vessels are specialized for conducting water and minerals.
- 9 (B)** CAM plants live in and desert conditions, and open stomata at night to fix  $\text{CO}_2$ .
- 10 (C)** Abscisic acid (ABA) promotes seed dormancy and inhibits seed germination.